(3.8) (3.13) より

$$(\bar{P}_{c2})_m = \frac{|I_0|^2}{8\pi\sin\theta}\sqrt{\frac{\pi f\mu_3}{\sigma_3}}\,k^{2m}K_{2m} = \frac{K_{2m}}{K_{1m}}(\bar{P}_{c1})_m \tag{6.3}$$

(4.6) (4.10) より

$$(\bar{P}_{d2})_m = \frac{f\lambda_2 p_2 \mu_0}{16}L_t\,|I_0|^2\,k^{2m} = \frac{p_2}{p_1}\,\frac{1}{k}(\bar{P}_{d1})_m \tag{6.4}$$

(5.5) (5.7) より

$$(\bar{W}_2)_m = \frac{\mu_0\lambda_2}{32\pi}L_t\,|I_0|^2\,k^{2m} = \frac{1}{k}(\bar{W}_1)_m \tag{6.5}$$

従つて

$$(\bar{P}_{d2})_m = 2\pi f p_2(\bar{W}_2)_m,\quad (\bar{P}_{d1})_m = 2\pi f p_1(\bar{W}_1)_m \tag{6.6}$$

となる。これらの近似式を (6.2) に代入すると，選択率 $Q$ は次の如くになる。

$$Q = \frac{\sum_{l=1}^{2n} k^l}{\left\{\frac{1}{\sin\theta_1}+\frac{1}{\sin(\theta_1+\delta\theta)}\right\}\frac{2\sqrt{\frac{\mu_3}{\pi f\sigma_3}}}{\mu_0\lambda_2 L_t}\left\{K_{10}+\sum_{m=1}^{(n-1)}k^{2m}(K_{1m}+K_{2m})+k^{2n}K_{2n}\right\}+\left\{p_1\sum_{m=0}^{(n-1)}k^{2m+1}+p_2\sum_{m=1}^{n}k^{2m}\right\}} \tag{6.7}$$

## 結　　言

以上大変粗雑な報告になつてしまつたが，一応所期の結果が得られたものと思う。即ち多段定在波回路の特徴である通り，後段に行く程蓄積エネルギーが急増し，且つ熱損失も増大するが，単位面積あるいは単位体積当りの熱損失はそれ程急増けしない様である。目下一二の例に就いて数値計算を行つている故，まとまり次第発表するが，なるべく早い機会に実験を行つて確めて見たいと思つている。

最後に，本研究の着手当時種々御教示を賜つた恩師，故黒川教授の霊に深く感謝の誠を捧げると共に，誤謬等お気付きの際には親しく御教示下さる様切にお願いして，擱筆する。

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# On the Method of Electing the Positions of the Tricot Cams.

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## (An Abstract)

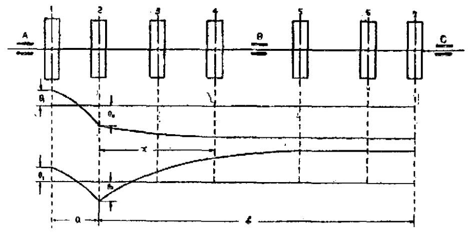
We have studied the relative positions of the tricot cams in various states, and found as a result that the positions of the tricot cams situated nearest to the positions of the bearing will cause least vibrations, for the least impact on the shaft will be made in such cases.

## (1) Introduction

In this discussion of torsional vibrations, the simple case of a shaft with seven rotating masses at the ends was considered.

In the diagram below are shown rotating a guide cam, a needle cam, a pressure cam, a sinker cam, a presser cam, a needle cam, and a guide cam fixed on the cam shaft. In the presant case, we placed the guide cam and the pressure cam at the nearest positions possible to the bearing. It is our object to find the effect of torsional vibretion of the cam shaft.

### (2) Theory of the Vibretion of the Tricot Machine



(Fig. 1)

Our purpose is to discuss the positions of the cams of the tricot machine. In Fig. 1 a state is shown in which a guide cam, a needle cam, a pressure cam, a sinker cam, a pressure cam, a needle cam, and a guide cam are fixed about the cam shaft. Our immediate purpose is to find the secure position of the cam which may effect the minimum degree of vibration on the needle. Let $I_1$, $I_2$, $I_3$, etc. be the moments of inertia of the rotating cams about the axis of the shaft.

Let $\theta_1$, $\theta_2$, $\theta_3$, etc. be the angles of rotation of these cams during vibration.

Let $k_1$, $k_2$, $k_3$, etc. be the spring constants of the shaft for the lengths between the first and the cam, and the second and the third cam, repectively.

Let $k_1(\theta_1-\theta_2)$, $k_2(\theta_2-\theta_3)$ etc. be the torque moments for the same length of every cam.

The moments of inertia of the rotating cams are have purposely neglected.

The potential energy of the vibration system, then, will be

$$V=\frac{1}{2}k_1(\theta_1-\theta_2)^2+\frac{1}{2}k_2(\theta_2-\theta_3)^2+\frac{1}{2}k_3(\theta_3-\theta_4)^2+\frac{1}{2}k_4(\theta_4-\theta_5)^2$$

$$+\frac{1}{2}k_5(\theta_5-\theta_6)^2+\frac{1}{2}k_6(\theta_6-\theta_7)^2 \quad\cdots\cdots(1)$$

and the kinetic energy of the viration system which consists in this case of the twist energy will be

$$T=\frac{I_1\dot\theta_1^2}{2}+\frac{I_2\dot\theta_2^2}{2}+\frac{I_3\dot\theta_3^2}{2}+\frac{I_4\dot\theta_4^2}{2}+\frac{I_5\dot\theta_5^2}{2}+\frac{I_6\dot\theta_6^2}{2}+\frac{I_7\dot\theta_7^2}{2} \quad\cdots\cdots(2)$$

in which,

$$\dot\theta=\frac{d\theta_1}{dt_1},\ \dot\theta_2=\frac{d\theta_2}{dt_2},\ \dot\theta_3=\frac{d\theta_3}{dt_3},\ \cdots\cdots\ \dot\theta_n=\frac{d\theta_n}{dt}$$

By putting the equations (1) and (2) in Lagrange's equations, we get the following equations :

$$\frac{d}{dt}\left(\frac{\partial T}{\partial\dot\theta_1}\right)-\frac{\partial T}{\partial\theta_1}+\frac{\partial V}{\partial\theta_1}=0$$

$$\therefore\quad I_1\ddot\theta_1+k_1(\theta-\theta_2)=0 \quad\cdots\cdots(3)$$

$$\frac{d}{dt}\left(\frac{\partial T}{\partial\dot\theta_2}\right)-\frac{\partial T}{\partial\theta_2}+\frac{\partial V}{\partial\theta_2}=0$$

$$\therefore\quad I_2\ddot\theta_2+k_1(\theta_1-\theta_2)+k_2(\theta_2-\theta_3)=0 \quad\cdots\cdots(4)$$

$$\frac{d}{dt}\left(\frac{\partial T}{\partial\dot\theta_3}\right)-\frac{\partial T}{\partial\theta_3}+\frac{\partial V}{\partial\theta_3}=0$$

$$\therefore\quad I_3\ddot\theta_3+k_2(\theta_2-\theta_3)+k_3(\theta_3-\theta_4)=0 \quad\cdots\cdots(5)$$

$$\frac{d}{dt}\left(\frac{\partial T}{\partial\dot\theta_4}\right)-\frac{\partial T}{\partial\theta_4}+\frac{\partial V}{\partial\theta_4}=0$$

$$\therefore\quad I_4\ddot\theta_4-k_3(\theta_3-\theta_4)+k_4(\theta_4-\theta_5)=0 \quad\cdots\cdots(6)$$

$$\frac{d}{dt}\left(\frac{\partial T}{\partial \dot{\theta}_5}\right)-\frac{\partial T}{\partial \theta_5}+\frac{\partial V}{\partial \theta_5}=0$$

$$\therefore \quad I_5\ddot{\theta}_5-k_4(\theta_4-\theta_5)+k_5(\theta_5-\theta_6)=0 \quad \cdots\cdots (7)$$

$$\frac{d}{dt}\left(\frac{\partial T}{\partial \dot{\theta}_6}\right)-\frac{\partial T}{\partial \theta_6}+\frac{\partial V}{\partial \theta_6}=0$$

$$\therefore \quad I_6\ddot{\theta}-k_5(\theta_5-\theta_6)+k_6(\theta_6-\theta_7)=0 \quad \cdots\cdots (8)$$

$$\frac{d}{dt}\left(\frac{\partial T}{\partial \dot{\theta}_7}\right)-\frac{\partial T}{\partial \theta_6}+\frac{\partial V}{\partial \theta_6}=0$$

$$\therefore \quad I_7\ddot{\theta}_7-k_6(\theta_6-\theta_7)=0 \quad \cdots\cdots (9)$$

in which

$$\ddot{\theta}_1=\frac{d^2\theta_1}{dt^2},\quad \ddot{\theta}_2=\frac{d^2\theta_2}{dt^2},\quad \ddot{\theta}_3=\frac{d^2\theta_3}{dt^2},\ \cdots\cdots \ddot{\theta}_n=\frac{d^2\theta_n}{dt^2} \quad \cdots\cdots (10)$$

Adding these equation together we get

$$\sum_{n=1}^{n=7} I_n\ddot{\theta}_n=0 \quad \cdots\cdots (11)$$

The equation (10) means that the moment of momentum of this system about the axis of the cam shaft of tricot machine remains constant buring free vibration.

Now, by substituting in the equations (3), (4), (5), (6), (7), and (8), (9) the following conditions

$$\theta_1=\lambda_1\cos Pt,\quad \theta_2=\lambda_2\cos Pt,\quad \theta_3=\lambda_3\cos Pt$$

we get

$$I_1\lambda_1P^2k_1(\lambda_1-\lambda_2)=0 \quad \cdots\cdots (12)$$

$$I_2\lambda_2P^2k_1(\lambda_1-\lambda_2)-k_2(\lambda_2-\lambda_3)=0 \quad \cdots\cdots (13)$$

$$I_3\lambda_3P^2k_2(\lambda_2-\lambda_3)-k_3(\lambda_3-\lambda_4)=0 \quad \cdots\cdots (14)$$

$$I_4\lambda_4P^2k_3(\lambda_3-\lambda_4)-k_4(\lambda_4-\lambda_5)=0 \quad \cdots\cdots (15)$$

$$I_5\lambda_5P^2+k_3(\lambda_3-\lambda_4)-k_4(\lambda_4-\lambda_5)=0 \quad \cdots\cdots (16)$$

$$I_6\lambda_6P^2+k_5(\lambda_5-\lambda_6)-k_6(\lambda_6-\lambda_7)=0 \quad \cdots\cdots (17)$$

$$I_7\lambda_7P^2+k_6(\lambda_6-\lambda_7)=0 \quad \cdots\cdots (18)$$

The frequency equations will be obtained by eliminating $\lambda_1$, $\lambda_2$, —from these equation.

These frequency equations may be solved by Rayleigh's method.

Now let a and b denote the distances of the second disk from the left hand ends of the shaft and let it be assumed that the shapes of the to principal models of vibrations are such as are shown in Fig. 1 and that part b of the deflection curve can be replaced by a parabola so that the angle of twist $\theta$ for any section $x$ distant from the second disk will be given by the equation

$$\theta=\theta_2+\frac{(\theta_7-\theta_2)(2b-x)x}{b^2} \quad \cdots\cdots (19)$$

In this case it is easy to learn that since $x=0$ and $x=b$, the angle $\theta$ in the above equation assumes the values $\theta_2$ and $\theta_7$ respectively.

By combinding the equation (12) and (18) and getting thereby

$$\theta_2=\frac{\theta_1}{k_1}(k_1-I_1P^2) \quad \cdots\cdots (20)$$

We learn that the angles of rotations of all other disk can be represented as functions of $\theta_1$ and $\theta_7$

The potential energy of this system is

$$V=\frac{c(\theta_1-\theta_2)^2}{2a}+\frac{c}{2}\int_0^b\left(\frac{d\theta}{dx}\right)^2dx=\frac{c(\theta_1-\theta_2)^2}{2a}+\frac{1}{2}c\int_0^b\left\{(\theta_7-\theta_2)^2\frac{(b-x)}{b^2}\right\}^2dx$$

$$=\left[\frac{\theta_1^2\gamma^2}{a}+\frac{4}{3}\frac{\{\theta_7-\theta_1(1-\gamma)\}}{b}\right] \quad \cdots\cdots (21)$$

in which

$$\gamma=\frac{I_1P^2}{k_1}$$

The kinetic energy of the system is

$$T=\frac{1}{2}\sum_{n=2}^{n=7}\frac{I_n\ \theta_n{}^2}{2} \quad \cdots\cdots(22)$$

in which let thedistance from the second disk to any rotating mass $r$ be $x_n$ and

$$\in_n=\frac{(2b-x_n)}{b}\ \frac{x_n}{b}$$

Then we obtain the following result :

$$T=\frac{1}{2}I_1\dot{\theta}^2{}_1+\frac{1}{2}\sum_{n=2}^{n=7}I_n\{\dot{\theta}_4\in_n+\dot{\theta}_1(1-\gamma)(1-\in_n)\}^2 \quad \cdots\cdots(23)$$

If we put the equation (12)~(18) in the following equation

$$\frac{p}{pt}\left(\frac{\partial T}{\partial\dot{\theta}_7}\right)-\frac{\partial T}{\partial\theta}+\frac{\partial V}{\partial\theta}=0$$

and substitute the following values

$$\theta_1=\lambda_1\cos(Pt+\beta),\ \theta_2=\lambda_2\cos(Pt+\beta),\ \cdots\cdots\ \theta_7=\lambda_7\cos(Pt+\beta)$$

We obtain the following results :

$$\lambda_1\{\gamma-\frac{4a}{3b}(1-\gamma)+\frac{\gamma(1-\gamma)}{I_1}\sum_{n=2}^{n=7}I_n(1-\in_n)^2\}+\lambda_4\{\frac{4a}{3b}+\frac{\gamma}{I_1}\sum_{n=2}^{n=7}I_n\in_n(1-\in_n)\}=0 \quad \cdots\cdots(24)$$

$$\lambda_1\left\{\frac{4a}{3b}(1-\gamma)+\frac{\gamma(1-\gamma)}{I_1}\sum_{n=2}^{n=7}I_n\in_n(1-\in_n)\right\}+\lambda_4\left\{-\frac{4a}{3b}+\frac{\gamma}{I_1}\sum_{n=2}^{n=7}I_n\in_n{}^2\right\}=0 \quad \cdots\cdots(25)$$

Next we change the distances a and to distances and, that is, placing the cams (1) (3), & (4), (7) as near as possible to the supports, and in this case the frequency equations (24) and (25) will be such as are shown in the following equations :

$$\lambda_1\left\{\gamma-\frac{4a'}{3b'}(1-\gamma)+\frac{\gamma(1-\gamma)}{I_1}\sum_{n=2}^{n=7}I_n(1-\in_n')^2\right\}$$

$$+\lambda_7\left\{\frac{4a'}{3b'}+\frac{\gamma}{I_1}\sum_{n=2}^{n=7}I_n\in_n'(1-\in_n')\right\}=0 \quad \cdots\cdots(26)$$

$$\lambda_1\left\{\frac{4a'}{3b'}(1-\gamma)+\frac{\gamma(1-\gamma)}{I_1}\sum_{n=2}^{n=7}I_n\in_n'(1-\in_n')\right\}$$

$$+\lambda_7\left\{-\frac{4a'}{3b'}+\frac{\gamma}{I_1}\sum_{n=2}^{n=7}I_n\in_n'^2\right\}=0 \quad \cdots\cdots(27)$$

In the above equation we may calculate

$$I_n,\ \frac{x_n}{b},\ (2-\frac{x_n}{b}),\ \in_n(1-\in_n),\ \in_n{}^2,\ I_n\in_n{}^2,\ (1-\in_n{}^2)^2,\ I_n(1-\in_n)^2,\ \in_n(1-\in_n)^2$$

and

$$\sum_{n=2}^{n=7}I_n\in_n{}^2,\ \sum_{n=2}^{n=7}I_n(1-\in_n)^2,\ \sum_{n=2}^{n=7}I_n\in_n(1-\in_n),$$

and then by equating the determinant of these equation to zero we shall obtain the frequency equation.

In this way we shall find out the advantage and disadvantage of the positions of cams by calculating the equation (24) (25) & (26) (27).

Thus we shall discuss easily the relative advantage of these two cases.

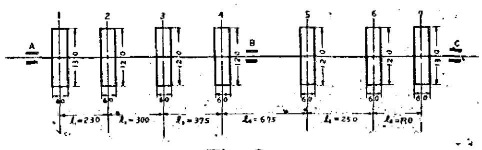



Fig. 2

$d=5\text{cm},\ G=8100\text{kg/cm}^2$

$$k_1=\frac{\pi d^4}{32}\cdot\frac{G}{23}=2.16\times10^6\text{kg/cm}^2 \qquad I_1=\frac{W}{8g}D_1{}^2=\frac{\frac{\pi}{4}\times13^2\times6\times7.8\times13^2}{8\times980\times1000}=0.133836\text{kg/cm}^2$$

$k_2=\frac{\pi d^4}{32}\cdot\frac{G}{30}=1.66\times10^6\mathrm{kg/cm^2}$ $I_2=0.097218\mathrm{kg/cm^2}$

$k_3=\frac{\pi d^4}{32}\cdot\frac{G}{37.5}=1.33\times10^6\mathrm{kg/cm^2}$ $I_3=0.097218\mathrm{kg/cm^2}$

$k_4=\frac{\pi d^4}{32}\cdot\frac{G}{67.5}=0.73\times10^6\mathrm{kg/cm^2}$ $I_4=0.09728\mathrm{kg/cm^2}$

$k_5=\frac{\pi d^4}{32}\cdot\frac{G}{25.0}=1.98\times10^6\mathrm{kg/cm^2}$ $I_5=0.09728\mathrm{kg/cm^2}$

$k_6=\frac{\pi d^4}{32}\cdot\frac{G}{19.0}=2.62\times10^6\mathrm{kg/cm^2}$ $I_6=0.09728\mathrm{kg/cm^2}$

$I_7=0.09728\mathrm{kg/cm^2}$

$a=23\mathrm{cm}$, $b=300+375+675+250+190=1790\mathrm{mm}=179.0\mathrm{cm}$

$d=5\mathrm{cm}$

$$\therefore\quad k_1=\frac{\pi d^4}{32}\cdot\frac{G}{l_1}=\frac{3.14\times5^4\times810000}{32\times11}=45.1\times10^6$$

$k_2=0.72\times10^6$

$k_3=4.51\times10^6$

$k_4=2.26\times10^6$

$k_5=0.63\times10^6$

$k_6=4.51\times10^6$

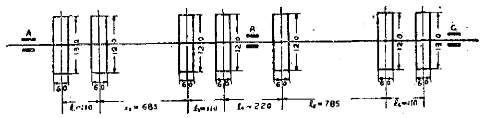


Fig. 3

$a'=11\mathrm{cm}$ $b=685+110+220+785+110=1910\mathrm{mm}=191\mathrm{cm}$

$b'=191\mathrm{cm}$

$a=23\mathrm{cm}$, $b=179\mathrm{cm}$, $\in_n=\frac{(2b-x_n)x_n}{b^2}=\left(\frac{2b-x_n}{b}\right)\frac{x_n}{b}$

| $n$ | $I_n$ | $\frac{x_n}{b}$ | $2-\frac{x_n}{b}$ | $\in_n$ | $1-\in_n$ | $\in_n^2$ | $I_n\in_n^2$ | $(1-\in_n)^2$ | $I_n(1-\in_n)^2$ | $\in_n(1-\in_n)$ | $I_n\in_n(1-\in_n)$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.13384 | — | — | — | — | — | — | — | — | — | — |
| 2 | 0.09722 | 0 | 2 | 0 | 1 | 0 | — | — | — | — | — |
| 3 | 0.09722 | 0.1675 | 1.8325 | 0.30594 | 0.69306 | 0.09422 | 0.009160 | 0.480327 | 0.046598 | 0.219729 | 0.0205815 |
| 4 | 0.09722 | 0.377 | 1.623 | 0.61187 | 0.38813 | 0.37439 | 0.036398 | 0.471004 | 0.045791 | 0.237489 | 0.023088 |
| 5 | 0.09722 | 0.755 | 1.245 | 0.93998 | 0.06003 | 0.8835 | 0.056455 | 0.003603 | 0.000350 | 0.056422 | 0.0049211 |
| 6 | 0.09722 | 0.895 | 1.105 | 0.98896 | 0.01103 | 0.97807 | 0.095088 | 0.000122 | 0.000012 | 0.010909 | 0.0010606 |
| 7 | 0.13384 | 1.000 | 1.000 | 1 | 0 | 1 | 0.13384 | 0 | 0 | 0 | — |
| | | | | | | | 0.308082 | 0.955056 | 0.092851 | 0.517545 | 0.0497515 |

$b'=191\mathrm{cm}$ $a'=11\mathrm{cm}$

| $n$ | $I_n$ | $\frac{x'n}{b}$ | $2-\frac{x'_n}{b}$ | $\in_n'$ | $1-\in_n'$ | $\in_n'^2$ | $I_n\in_n'^2$ | $(1-\in_n')^2$ | $I_n(1-\in_n')^2$ | $\in_n(1-\in_n')$ | $I_n\in_n'(1-\in_n')$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.13384 | — | — | — | — | — | — | — | — | — | — |
| 2 | 0.09722 | 0 | 2 | 0 | 1 | — | — | — | — | — | — |
| 3 | 0.09722 | 0.349 | 1.651 | 0.576548 | 0.423452 | 0.3324076 | 0.03231667 | 0.1793116 | 0.0174322 | 0.244140 | 0.0237353 |
| 4 | 0.09722 | 0.471 | 1.529 | 0.720159 | 0.279841 | 0.518629 | 0.05042111 | 0.07831099 | 0.00761339 | 0.201530 | 0.0195927 |
| 5 | 0.09722 | 0.599 | 1.471 | 0.778159 | 0.221841 | 0.6055314 | 0.05886997 | 0.04921343 | 0.00478453 | 0.1726276 | 0.01678285 |
| 6 | 0.09722 | 0.942 | 1.058 | 0.996636 | 0.003364 | 0.9932833 | 0.096567 | 0.00001132 | 0.000001101 | 0.0033527 | 0.0000326 |
| 7 | 0.13384 | 1.000 | 1 | 1 | 0 | 1 | 0.13384 | 0 | — | — | — |
| | | | | | | | 0.37201455 | 0.30534734 | 0.029831721 | 0.6216507 | 0.2354783 |

$$\lambda_1\left\{r-\frac{4}{3}\times\frac{23}{179}(1-r)+\frac{r(1-r)}{0.13384}\times0.09285\right\}+\lambda_7\left\{\frac{4}{3}\times\frac{23}{179}+\frac{r}{0.13384}\times0.0497515\right\}=0$$

$$\lambda_1\left\{\frac{4}{3}\times\frac{23}{179}(1-r)+\frac{r(1-r)}{0.13384}\times0.0497515\right\}+\lambda_7\left\{-\frac{4}{3}\times\frac{23}{179}+\frac{r}{0.13384}\times0.308032\right\}=0$$

$$1.4586r^3-3.6124r^2+0.7531r=0$$

$$r=0.231$$

$$\lambda_1\left\{r-\frac{4}{3}\times\frac{11}{191}(1-r)+\frac{r(1-r)}{0.13384}\times 0.0298317\right\}+\lambda_7\left\{\frac{4}{3}\times\frac{11}{191}+\frac{r}{0.13384}\times 0.236478\right\}=0$$

$$\lambda_1\left\{\frac{4}{3}\times\frac{11}{191}(1-r)+\frac{r(1-r)}{0.13384}\times 0.236478\right\}+\lambda_7\left\{-\frac{3}{4}\times\frac{11}{191}+\frac{r}{0.13384}\times 0.372014\right\}=0$$

$$\lambda_1\{r-0.0767(1-r)+r(1-r)\times 0.2228\}+\lambda_7\{0.0767+1.7658r\}=0$$

$$\lambda_1\{0.0767(1-r)+1.7668r(1-r)+\lambda_7\{-0.0767+2.778r\}=0$$

Similary

$\therefore \quad r=0.391$

then,

$$k_1=2.16\times 10^6 \qquad I_1=0.1338 \qquad r=0.231$$

$$P_1=\sqrt{\frac{0.231\times 2.16\times 10^6}{0.1338}}=1931.1$$

$$f_1=\frac{1931.1}{2\times 3.1416}=307.34\text{cycle/sec}$$

$$k_2=4.51\times 10^6 \qquad I_2=0.1338 \qquad r_2=0.391$$

$$P_2=\sqrt{\frac{0.391\times 4.51\times 10^6}{0.1338}}=3630.3$$

$$f_2=\frac{3630.3}{2\times 3.1416}=577.78\text{cycle/sec}$$

By compairing $f_1$, and $f_2$ we gain the following conclusion,

### (3) Conclusion

In this discussion the free torsional vibration of shaft was considered and the frequencies of the natural vibrations were deter mined. When we changed the position of cams at the nearest position of the bearing, the torsional vibrations shall have the least valve of the vibration and then the least impact on the shaft.

We belieued that this changed positions of cams shall have the best conditions for the vibration by calculating the above two example.

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## On the physical properties under the chemical treatment of leathers.

K. OKUDA, I. TSUJIMOTO.

### (An Abstract)

In this discussion, our objects are satisfied by researching the chemical and physical properties of leathers on their stress-strain curves, and comparision of their energies under various condition.

### (1) Introduction

We compaired the strength of leathers with each other under various thickness as follow.

We took several test-pieces under dry condition.

By tensile testing machine we measured the mechanical properties under its constant pulling speed and we gained the following results.